Paying Tribute to Alan Turing's Life and Work

The Turing Guide. *By Jack Copeland, Jonathan Bowen, Mark Sprevak, and Robin Wilson. Oxford University Press, New York, NY, March 2017. 545 pages. $115.00.*

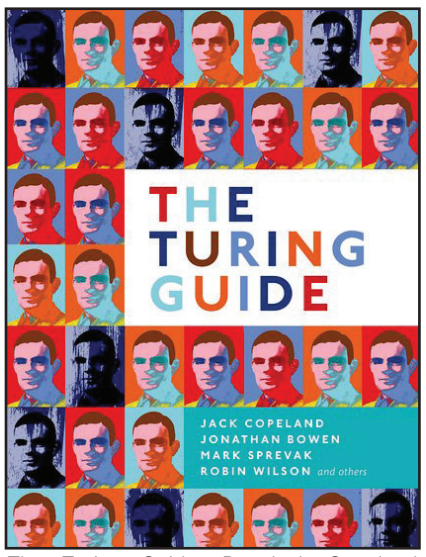
BOOK REVIEW
By Ernest Davis

June 23, 2012 was the 100th birthday of the renowned Alan Turing. The year was designated as "the Alan Turing Year," and 21 different countries celebrated with numerous events, conferences, special issues of journals, and books. *The Imitation Game,* a 2014 biopic loosely based on Turing's decryption work during World War II, was enormously successful.

A little late to the party but still very welcome is *The Turing Guide*, a collection of 42 fascinating essays covering every aspect of Turing's life and work. It traces the consequences of Turing's ideas and labors in the 60 years since his death. The essays are deeply researched, well written, and cogently argued, and the book itself is beautifully produced and amply illustrated with photographs, line drawings, diagrams, and cartoons.

Alan Turing at Sherborne School in 1930. Photo courtesy of Oxford University Press, reproduced with permission from Beryl Turing.

Jack Copeland, a logician and historian at the University of Canterbury in New Zealand, appears to be *The Turing Guide*'s chief moving spirit. He has authored or coauthored 13 of the essays in this volume, having previously written a full-length biography of Turing and five other books on aspects of his work. Other contributors include mathematicians, computer scientists, logicians, philosophers, psychologists, engineers, biologists, historians, and museum professionals. Turing's nephew, Sir John Dermott Turing, and novelist David Leavitt also offer insight. Seven of the contributors who knew Turing personally wrote about their interactions at Bletchley Park—the site for British codebreakers during World War II—and one contributor described his work with Turing on his theory of morphogenesis.



The Turing Guide. By Jack Copeland, Jonathan Bowen, Mark Sprevak, and Robin Wilson. Courtesy of Oxford University Press.

Turing's revolutionary achievements, his wide-ranging scientific interests, his work's lasting and future significance, and his personal tragedy are recounted and analyzed in depth. Most of the book naturally deals with the four great milestones of his career:

(i) Computation theory. Turing's amazing 1936 paper, "On Computable Numbers," laid the foundations of computation theory, defined the Turing machine and confirmed the existence of a universal Turing machine, demonstrated the undecidability of the machines' fundamental problems, and--almost in passing—answered David Hilbert's "Entscheidungsproblem" by proving that provability is undecidable.

(ii) Code breaking. In World War II, Turing was the scientific leader of the team at Bletchley Park that broke the German's naval Enigma code. This was of enormous value to the Allied powers, particularly in protecting trans-Atlantic shipping from U-boat attacks.

(iii) Electronic computer. After the war, Turing was deeply involved with the development of electronic computers in Great Britain. Turing's 1945 report on the Automatic Computing Engine developed a detailed design of a stored-program computer. In 1948, he joined Max Newman's lab in Manchester and played a leading role in the development of the Manchester computer.

(iv) Artificial intelligence. Turing was a pioneer and early visionary in artificial intelligence (AI). He developed the first chess-playing program by proposing a number of research methods—some have been fruitful, others may yet be fruitful—and positing the Turing test as a measure of successful realization of machine intelligence.

There is much else besides. In the early 1950s, Turing developed a powerful theory of biological morphogenesis. In fact, that paper has more citations on Google Scholar than any of his papers on computation theory or AI. However, as Margaret Boden noted in her essay, this likely says more about the limitations of Google Scholar's citation count as a measure of impact than about the actual relative importance of the work. Turing worked in a number of mathematical areas beyond logic and computation theory, including the central limit theorem, the theory of normal numbers, the word problem in group theory, and the Riemann hypothesis. Working with Christopher Strachey, he created the first computer music; in 1951, the Manchester computer gave a small concert consisting of "God Save the King," Glenn Miller's "In the Mood," and "Baa Baa Black Sheep." Additionally, in an often-ignored section of his paper on "Computing Machinery and Intelligence," which introduced the Turing test, Turing also endorsed parapsychology; Leavitt's chapter in the book discusses the scientific and cultural context of that unexpected intrusion.

The essays do at times go a bit overboard in their worshipful attitude. A book focused on a single individual inevitably and reasonably emphasizes the importance of its hero, but this can be taken too far. It seems quite unfair, in an extended historical discussion of computation theory and the Turing machine, to leave entirely unmentioned Emil Post's independent discovery of essentially the identical model (it was actually slightly simpler), which published six months later. Furthermore, it is pretty much meaningless to claim, as Copeland does, that "If Isaac Newton had known about [the Turing machine], he probably would have wished he had thought of it first." I am not sure what the proper consequent is for the counterfactual "If Newton had known about the Turing machine," but it seems clear that, if Newton had known about it, he would have thought of it before Turing. Boden expresses absolute certainty that a large collection of handwritten mathematical notes, which were found after Turing's death and have thus far been indecipherable, are a "treasure trove" of mathematical insights of potential relevance to theoretical biology; perhaps they are, but that is pure speculation.

Also, despite *The Turing Guide*'s joyous celebration of Turing's growing fame, there seems to be a steady undercurrent of resentment that he isn't even more famous. Of course, Turing *was* gravely undervalued for decades—the Bletchley work was kept so secret that Turing's own mother, who died in 1976, never knew what her son had done—and the book makes a cogent case that, in general, British accomplishments in computer development have remained underappreciated compared to American achievements. However, one would think that Turing is largely getting his due at this point. Nonetheless, Boden seems bothered that Francis Crick and James Watson's discovery of the structure of DNA overshadowed Turing's theory of morphogenesis. Copeland appears to be irked by the observation that Albert Einstein is more famous than Turing, and notes that Einstein had a long head start. Most preposterous is a claim by Richard Dawkins (in fairness, Copeland observes that this is "laudable but not entirely accurate") that Turing possibly made a larger contribution to the victory in World War II than Dwight D. Eisenhower or Winston Churchill.

Nevertheless, excessive admiration for an enormously admirable figure is surely one of the most forgivable of intellectual failings. All in all, *The Turing Guide* is an important and valuable contribution to our understanding of an extraordinary scientist and the profound and lasting resonances of his work.

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